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RESEARCH ARTICLE

Solving the puzzle: The effects of contextual information and feedback on the interpretation of a crime scene

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Abstract

In this study, we examined how the provision of contextual information and the ability to ask questions and obtain feedback affected mock investigators' interpretation of a crime scene. Participants were randomly assigned to 1 of 4 conditions in a 2 × 2 design and assessed two photographs of the same crime scene. Participants were instructed to write a narrative about what they thought had happened at the scene. Results showed that the provision of contextual information and the ability to ask questions had no effect on the lengths of the narratives participants produced. However, participants who received contextual information wrote a more factual narrative containing more descriptions of *actions* before, during, and after the crime. Across all conditions, most of the questions were asked about *persons* who could in some way be involved in the crime. Results of this study indicate that the provision of contextual information helped participants to focus on the more factual, rather than speculative elements, of the crime.

KEYWORDS

contextual information, crime scene investigation, decision-making, feedback, reasoning

1 | INTRODUCTION

When investigators arrive at a crime scene, they are required to reconstruct what has happened, often based on very little information. One challenge during the investigation is that many different events could result in crime scenes that are, on the face of it, similar. For example, the presence of large quantities of blood could be the result of a violent struggle, or a self-inflicted injury. Thus, it is rare that physical evidence at a crime scene points unambiguously to one

conclusion about the events that transpired. Contextual information, coming for instance from the emergency call or a witness statement, may sometimes play a crucial role in aiding interpretation of an ambiguous crime scene and guide the search for further evidence. For example, we know that providing contextual information can help people arrive at novel and insightful solutions to otherwise insoluble problems (e.g., Gick & Holyoak, 1980). On the other hand, contextual information can also be a threat to the objectivity of an investigation because it can constrain and guide the perception and interpretation of the available information—leading to confirmation bias (Nickerson, 1998).

Research in various disciplines has shown that contextual information (for example, in the form of incriminating or exculpating evidence) shapes expectations and can bias decision-making (e.g., Kassin, Dror, & Kukucka, 2013; Rosenthal, 1994). In one study, Dror, Charlton, & Péron (2006) demonstrated the biasing influence of contextual information by asking five experienced fingerprint experts to assess pairs of fingerprints. The experts were unaware that they had examined the same fingerprints years earlier and had then stated they were match. Before the stimuli were represented, these examiners were given information implying that the prints were not a match. After examining them a second time, only one of the five experts judged the fingerprints to be a match.

The aim of this study was to investigate how the provision of contextual information and the ability to ask questions and obtain feedback on their reasoning affected mock investigators' interpretation of an ambiguous crime scene.

1.1 | Evidence interpretation

The interpretation of a crime scene is driven by the same “bottom up” and “top down” perceptual and attentional processes that guide the interpretation of any other kind of scene (e.g., Wolfe, 1994). For example, attention may be directed bottom up by the properties of the stimulus (e.g., bloodstain on white floor), and other times, it may be directed top down by the observer's goals and beliefs (e.g., they have been called to a house where there have been reports of domestic violence previously). These two attentional processes interact to determine the focus of attention (Egeth & Yantis, 1997; Theeuwes, 2010).

Contextual information can shape our perception particularly when a stimulus is ambiguous, as is the case with visual illusions (Balcetis & Dunning, 2006; Scocchia, Valsecchi, & Triesch, 2014). The psychological work on visual illusions shows that prior information (e.g., a preceding series of pictures) can bias our perception of visual scenes—even if we are aware of the source of the bias (e.g., Fisher, 1968; Gregory, 1968). Furthermore, a large body of research has demonstrated that contextual information affects the efficiency of information search and the recognition of objects. For example, objects are more easily recognised when they are presented in a coherent scene with other related objects than when they are presented in a context with unrelated objects (e.g., Auckland, Cave, & Donnelly, 2007; Bar, 2004; Biederman, Mezzanotte, & Rabinowitz, 1982; Palmer, 1975).

1.2 | The effect of schemas on recall

Contextual information in a criminal investigation can include physical evidence, the crime scene itself, statements from witnesses, victims or suspects, and data from police records. The information may be (intentionally or unintentionally) ambiguous, incomplete, contradictory, or irrelevant. The task of the crime scene investigator is to interpret and evaluate relevant information, to investigate the crime scene while ignoring irrelevant information. That task involves complex problem solving and reasoning. Investigating a crime scene, where there may be limited information, is therefore a process of decision-making under uncertainty. One of the factors that can affect information processing at the crime scene are schemas.

World knowledge and information from previous experiences can be used to interpret new situations. The organised collections of information stored in long-term memory are called schemas that help guide the perception and interpretation of information in the environment (Bartlett, 1932; Hastie, 1981). They also provide a framework for retrieving information from memory (e.g., Alba & Hasher, 1983). Schemas can thus effectively guide attention to areas or aspects of an event that are thought to be relevant (e.g., Tuckey & Brewer, 2003). On the other hand, what

is perceived may be incorrectly interpreted in a way consistent with the schema (De Poot, Bokhorst, van Koppen, & Muller, 2004; Johnson-Laird & Wason, 1977). Thus, schemas may help or hinder the reconstruction of a crime scene. However, expertise may play an important role in how schematic information is used.

The more experienced a crime scene investigator is, the more—or better developed—schemas he or she may have to draw on. It is also possible that experienced crime scene investigators are better able to access schematic knowledge more effectively depending on given context. In other words, experts may outperform non-experts because they are able to use their schematic knowledge more flexibly (see Gobet, 1998 for an overview of concepts of expert memory). Schematic knowledge may impact the way they assess a crime scene and may increase the chances of finding traces (De Poot et al., 2004). A mechanism that may explain the way in which schemas influence decision-making is the recognition-primed decision theory of expert judgement by Klein (1989, 1997). It presents an account of expertise that is based on situational awareness: recognising a situation as appropriate for a particular course of action triggers an appropriate rule-based response decision. For example, if an experienced crime scene investigator has to investigate a burglary and—drawing on their previous experience or schemas—has successfully found traces at specific locations during previous investigations of burglaries, he or she is more likely to search for and select traces in similar areas (Baber & Butler, 2012).

1.3 | Real-life decision-making

Many real-world inferences are made in situations where there are multiple competing demands on our cognitive capacities. These constraints are ignored by classical models of rational decision making (Edwards, 1954), which assume unlimited time, knowledge, and cognitive capacity to make the most optimal decision (Gigerenzer, 2001). In real-life situations, people tend to rely on heuristics to make fast and frugal decisions (Gigerenzer, Todd, & ABC Research Group, 1999). Heuristics are intuitive problem-solving strategies to address a specific problem and can be based on previous experiences with similar problems. These heuristics enable us to organise and prioritise large amounts of information and draw conclusions even when the information is incomplete or ambiguous. Previous studies have demonstrated that decision-making based on heuristics can lead to equal or better quality decisions than complex statistical models that include all the information available (Dhmi, 2003; Dhmi & Harries, 2001; Gigerenzer et al., 1999; Smith & Gilhooly, 2006; Snook, Taylor, & Bennell, 2004). Although heuristic thinking can be efficient and beneficial, it can also produce systematic errors, or biases, in judgement, especially when prior expectations exist (Gigerenzer et al., 1999; Tversky & Kahneman, 1974).

1.4 | Reasoning with evidence—The story model

Reconstructing a crime—whether by a crime scene investigator, or a jury—involves more than simply summing up the evidence at the scene. Bennett and Feldman (1981) were the first to propose that the criminal trial is organised around storytelling. According to these researchers, a story is organised around a central action. The rest of the story serves as the context to this central action. A few years later, the story model was introduced as an explanation based theory of decision-making by jurors (Pennington & Hastie, 1986). The rationale behind the model is that jurors construct a narrative story (a causal model) to organise and explain trial information. The authors argue that when the body of evidence relevant to a decision is “large, complex, and the implications of its constituents are interdependent, the decision process is explanation based” (Pennington & Hastie, 1992, p. 189). A distinctive assumption of the model is that decision makers’ reason about the evidence in order to construct a representation and that this representation is an interpretation of the original evidence. The representation, and not the evidence itself, is the basis of the final decision (Pennington & Hastie, 1993).

A good story consists of a central action and a context that allows for an easy interpretation of that action. Wagenaar, Van Koppen, and Crombag (1993) have built on the story model approach and proposed the anchored narratives theory. According to this theory, legal decisions should be based on stories that have to be anchored in

common sense knowledge. A well-anchored narrative is nested in several sub-narratives. These sub-narratives are more detailed and can be arranged hierarchically.

1.5 | The power of narratives

Constructing a narrative can help crime scene investigators to organise the information. In both of the above narrative models, meaning is assigned to evidence through the incorporation of that evidence into one or more plausible stories about what happened (Pennington & Hastie, 1986, 1992, 1993; Wagenaar et al., 1993). For crime scene investigators, meaning can be assigned to trace evidence in the same way, namely through the incorporation of the trace evidence into one or more plausible stories (e.g., bloodstains could be the result of a violent assault, or a self-inflicted accident) to make sense of the evidence (Baber & Butler, 2012; Baber, Smith, Cross, Hunter, & McMaster, 2006). The elements that are the basis of the reconstruction of the crime are often based on answers to the seven golden criminalistic Wh-questions (De Poot et al., 2004; Gross, 1893). These are questions starting with the words who, what, where, when, what with, in what way, and why that are used as a framework to reconstruct a crime.

1.6 | Information search and feedback

Asking questions to help formulate a hypothesis and solve a problem is not only used in criminal investigations. Clinical questions, for instance, can help with the information search in medical decision-making (e.g., Haroon & Philips, 2010). Receiving answers to those questions may help to verify or falsify hypotheses about what has happened, fill out the missing elements, and construct the most plausible narrative. The importance of information in the criminal investigation process has been stressed in the literature (e.g., Innes, 2003), but little is known about what information investigators search for, and need, in order to reconstruct events at the crime scene.

Thus far, we have discussed several theories about reasoning and decision-making (schema, heuristic, and narrative models). They can be both beneficial (allowing experts to make fast, effective decisions based on similar events they have seen) and detrimental (they can lead to schema consistent, plausible, and convincing narratives that may nevertheless be wrong). As discussed previously, crime scene investigators rarely encounter a crime scene without knowing anything about the scene they are going to investigate. We therefore examined the effects of providing such contextual information on the way in which people reason about a crime scene. Furthermore, during the investigation of a scene, narratives are developed about what has occurred. We reasoned that the ability to ask additional questions to test out a theory might also have impacted the final interpretation of the scene (e.g., Klein, 1997).

1.7 | This study

The aim of this study was to investigate how people reason about and reconstruct a crime scene. Specifically, we were interested in whether contextual information, and the ability to ask further questions, impacted participants' perception and interpretation of a crime scene. Our first hypothesis predicted that the narratives of participants who were provided with more contextual information would be more extensive, composed of different elements, and that confidence in its accuracy would be higher compared to narratives of participants who were not provided with such information, because they had more resources with which to reconstruct the crime. Our second hypothesis predicted that the number and type of questions being asked would be dependent on whether or not participants had received contextual information. When allowed to ask questions, our third hypothesis predicted that participants would report higher confidence in the accuracy of their narrative, would report that they received enough information to write the narrative, and would write a longer narrative consisting of more different elements, compared to participants who were unable to ask questions.

2 | METHOD

2.1 | Design

Participants were randomly assigned to one cell of a 2 (contextual information provided: Yes; No) \times 2 (questions allowed: Yes; No) independent groups design. The contextual information consisted of the time and date of the incident and details of the victim's gender, age, and criminal history, as well as noises that were reported by the neighbours. Additionally, for those participants who were given the option to ask questions, the number and content of questions asked were recorded. Participants wrote their questions on a piece of paper and the answers were provided in writing by the experimenter on the same piece of paper. Dependent measures were length of narrative (word count), content of narrative (see section below), and confidence in accuracy of narrative (ranging from a score of 1, *meaning very unconfident*, to 9, *meaning very confident*), feeling that they had enough information to write the narrative (on a scale of 1, *meaning no, not at all*, to 9, *meaning yes, definitely*), and how motivated they were to make a proper reconstruction (on a 1–9 Likert scale, 1 *meaning not at all motivated*, 9 *meaning very motivated*). Also, it was recorded (Yes/No) whether participants wrote down the correct scenario (in this case, an accident) as a possible interpretation of the crime scene.

2.2 | Participants

Sixty participants (22 male, 38 female, mean age = 23.65 years, *SD* = 9.80 years) from the University of Portsmouth, UK took part in this study. They were recruited via posters displayed around the university campus and participated in return for course credit. The students were mainly psychology students who had limited knowledge of forensic investigations and trace evidence. The study was given a favourable opinion by the University of Portsmouth Science Faculty Ethics Committee.

2.3 | Materials

Two genuine crime scene photographs were presented to the participants. A stopwatch was used to time the 5 min each participant had to carefully assess the photographs in isolation. Participants were provided with a pen and an answer booklet to write down their narrative and fill out the Likert scales. Additionally, if participants were in the question condition, they were provided with an extra piece of paper to write down their questions.

2.4 | Coding of the narratives and questions

All participants provided a written free narrative of what they thought had happened at the crime scene and why, based on the information they had at their disposal. The word length of each narrative was coded. Furthermore, the narratives were coded according to a predefined coding scheme, which was adapted from the PALIT-scheme (see Oxburgh, Ost, & Cherryman, 2012). The coding scheme included the following categories: Person information; Action information; Location information; Item information; Temporal information, and we added Motive information. Each item was only counted once and repetitions were ignored. The following example phrase illustrates the coding scheme: "The victim (1 \times Person) came home from a shopping trip (1 \times Action) drank (1 \times Action) a glass of milk (1 \times Item) and started to make breakfast (1 \times Action), for her (1 \times Person) and her son (1 \times Person)."

In order to compare scores between participants whose written narratives differed in length, we calculated a ratio for each participant. In each narrative, the total number of PALIT-items was counted, the same was done for the questions each participant asked, and we then divided the number of each individual PALIT-item (i.e., Person, Action, Location, Item, Temporal and Motive) by the total number of PALIT-items in the narrative and questions, giving us proportions that were used in the analyses. Similar proportion scores were calculated for facts¹ and interpretations contained in the participants' written narrative. Facts could be derived from the prior information (e.g., gender and

age of the victim), visual information in the crime scene photographs (e.g., objects in the crime scene), or from answers to the questions. Interpretations were chunks of information in the narrative that were not facts. An example phrase is "I see a glass of milk (1× fact) on the table (1× fact), they must have just finished eating breakfast (1× interpretation)."

For those participants who were allowed to ask questions, the number of questions asked was counted. The questions were coded according to the same PALIT-coding scheme. The following examples illustrate how the questions were coded: "Who made the emergency call?" (1× Person-question), "Was a weapon found at the scene?" (1× Item-question).

A second coder was provided with the coding scheme and also coded two narratives. The number of facts, interpretations, and PALIT-items of the coded narratives were counted and compared. The level of agreement between the two coders was 93% for the facts and interpretations and 95% for the PALIT-items.

2.5 | Procedure

Participants were tested individually in research cubicles. Each participant was asked to view two coloured photographs of a real crime scene for 5 min in isolation. The photographs were from the same crime scene, but taken from a different angle. The photographs showed a living room with a large pool of blood and several items scattered around the floor. There were no weapons or bodies visible. The contextual information was fabricated and did not contain details of the actual incident. There was no information present that could identify a victim, suspect, or the police officers that were involved in the original case.

Half of the participants had the option to ask clarification questions and the other half had not. The participants who were allowed to ask questions received standardised answers. The answers to possible questions were predetermined, with help of experienced scene of the crime officers (See Appendix A for the full list of questions). If a participant asked a question that was not on the list of questions with standardised answers, they were told that there was "no information available."

Participants wrote their questions on a separate piece of paper and the answers were provided on the same piece of paper by the experimenter. All participants then provided a written free narrative and were instructed to "write down what you think has happened at this scene and why you think this has happened in as much detail as you can" and completed the three Likert scale measures. They also completed a short post-study questionnaire asking about (a) their confidence in the accuracy of the narrative, (b) if they felt that they had enough information to write the narrative, and (c) how motivated they were to make a proper reconstruction of the event. During the whole experiment, participants had access to the crime scene photographs. Finally, they provided their demographic information (age, gender, and University course). Lastly, they were thanked and debriefed as to the purpose of this study. There was no time limit, but the experiment took approximately 45 min to complete.

3 | RESULTS

3.1 | Motivation scores

To ensure that participants were taking the experiment seriously, they were asked how motivated they were to make a proper reconstruction. In all conditions, participants showed high average motivation scores on a 1–9 point Likert scale (contextual information $M = 7.87$, $SD = 1.20$, no contextual information $M = 7.97$, $SD = 0.96$, questions $M = 8.03$, $SD = 1.03$, no questions $M = 7.80$, $SD = 1.13$), indicating that participants were motivated to complete the task. A 2×2 independent groups ANOVA was performed to assess whether motivation scores differed between the conditions. Results revealed no main effect of contextual information $F(1, 56) = 0.13$, $p = .72$, ability to ask questions $F(1, 56) = 0.69$, $p = .41$, and no interaction $F(1, 56) = 0.69$, $p = .41$ on motivation scores.

3.2 | Narrative

3.2.1 | Word count

First, these data were screened for outliers. The raw (untransformed) word count was non-normally distributed with skewness of 3.80 ($SE = 0.31$) and kurtosis of 20.47 ($SE = 0.61$). One case was identified as an outlier. This participant was in the contextual information and no questions condition. The narrative of this participant included 927 words, compared to 187 average word length. Removing this participant's data brought skewness (1.13, $SE = 0.31$) and kurtosis (1.07, $SE = 0.61$) into an acceptable range. The total number of words in each narrative after excluding the outlier was counted ($M = 174.53$, $SD = 79.31$, range = 59–416). A 2×2 independent groups ANOVA was performed. There was no significant main effect of contextual information $F(1, 55) = 1.70$, $p = .20$ or of the opportunity to ask questions $F(1, 55) = .13$, $p = .72$, and no significant interaction effect on the number of words that participants used $F(1, 55) = 2.02$, $p = .16$. The rest of the analyses were conducted with proportions to account for differences between the lengths of the narratives and number of questions (see Section 2). Therefore, the case that was identified as an outlier was included in the analyses below.

3.2.2 | Proportion of facts

A 2×2 ANOVA revealed a significant main effect of receiving prior information on the proportion of facts that participants reported in their narrative $F(1, 56) = 4.96$, $p = .03$, $\eta^2 = .08$. The narratives of participants who received prior information contained significantly more facts ($M = 0.38$, $SD = 0.09$) than the narratives of participants who did not receive prior information ($M = 0.32$, $SD = 0.11$). There was no main effect of having the opportunity to ask questions ($M = 0.35$, $SD = 0.10$) or not ($M = 0.36$, $SD = 0.11$) on the proportion of facts in the narrative $F(1, 56) = 0.24$, $p = .63$, and no significant interaction between contextual information and asking questions on the proportion of facts in the narrative $F(1, 56) = .34$, $p = .56$.

3.2.3 | Proportion of PALIT-information

Descriptive analyses showed that the narratives consisted mainly of Action items ($M = .43$, $SD = .09$, range = 0.23–0.62), followed by Item-information ($M = .23$, $SD = .10$, range = 0.00–0.43); Person-information ($M = .17$, $SD = .05$, range = 0.08–0.32); Location-information ($M = .16$, $SD = .05$, range = 0.07–0.26); Motive-information ($M = .01$, $SD = .02$, range = 0.00–0.07); Temporal-information ($M = .01$, $SD = .01$, range = 0.00–.06). We conducted six independent groups ANOVAs to assess whether the proportion of specific types of PALIT-information in the narratives varied across conditions. There were no differences in the proportion of PALIT-information as a function of whether participants received contextual information or not (p values from .10 to .87). However, participants who were allowed to ask questions reported significantly more Action-information in their narratives compared to participants who were not allowed to ask questions $F(1, 56) = 7.92$, $p = .01$, $\eta^2 = .12$, and significantly fewer Item-information compared to participants who were not allowed to ask questions $F(1, 56) = 9.62$, $p < .001$, $\eta^2 = .15$. There were no significant effects of the ability to ask questions or not on any of the other PALIT-information reported by participants (p values ranged from .09 to .78).

3.2.4 | Confidence in accuracy of the narrative

A 2×2 independent groups ANOVA with participants' confidence scores as the dependent variable revealed no significant main effects of receiving contextual information $F(1, 56) = 0.22$, $p = .64$, the opportunity to ask questions $F(1, 56) = 0.77$, $p = .39$, and no interaction $F(1, 56) = 0.77$, $p = .39$. Furthermore, a 2×2 independent groups ANOVA on participants' reports of feeling that they had enough information to base their narrative on showed no significant main effect for contextual information $F(1, 56) = 0.85$, $p = .36$, asking questions $F(1, 56) = 0.03$, $p = .85$, and no interaction $F(1, 56) = 0.10$, $p = .76$.

3.2.5 | Correct scenario

Most participants (80%) wrote down only one crime scenario ($M = 1.23$, $SD = 0.05$, range = 1–3). We also scored whether the crime scene was interpreted correctly (i.e., in this case, an accident). Fifty-eight out of 60 participants wrote down a scenario with a clear indication of what had happened, but only 12 (20%) of these 58 correctly interpreted the scene as being an accident instead of a crime. Participants who interpreted the crime scene correctly wrote down multiple scenarios significantly more often $t(56) = 2.78$, $p < .05$. However, a chi-square test showed no significant association between the provision of contextual information, the opportunity to ask questions, and the correct interpretation of the crime scene $\chi^2(3) = 1.03$, $p = .79$.

3.3 | Questions asked by participants

3.3.1 | Number of questions

An independent sample's t test was performed to compare the number of questions asked in the contextual information condition ($n = 15$) and the no contextual information ($n = 15$) conditions. Participants in the contextual information condition did not ask more questions compared to participants in the no prior knowledge condition $t(28) = 0.69$, $p = .50$.

3.3.2 | PALIT-information

Across all conditions, most of the questions asked by participants concerned Person-information ($M = .57$, $SD = .26$, range = 0.14–1.00), followed by Item-information ($M = .22$, $SD = .21$, range = 0.00–0.75); Location-information ($M = .09$, $SD = .11$, range = 0.00–0.33); Action-information ($M = .08$, $SD = .09$, range = 0.00–0.29); Temporal-information ($M = .02$, $SD = .04$, range = 0.00–0.14); Motive-information ($M = .02$, $SD = .03$, range = 0.00–0.10). Six one-way independent ANOVAs revealed no significant differences between participants with or without contextual information with regards to the PALIT-information they asked questions about (p values ranged from .06 to .71). Table 1 summarises the key findings.

4 | DISCUSSION

The main aim of this study was to examine the effects of contextual information and allowing questions on the reconstruction of events before, during, and after a crime. The first hypothesis predicted that the narrative of participants who received contextual information would be composed of different elements, compared to those who were not provided with contextual information. Furthermore, we expected that the narratives of participants who were allowed to ask questions would consist of different elements compared to narratives of participants who could not ask questions. The analyses conducted to test these hypotheses showed that the narratives of people who were allowed to ask questions indeed consisted of different elements; specifically, they contained significantly more *Action*-items and fewer *Item*-items. However, there was no significant difference between the contextual

TABLE 1 Summary of significant results in relation to hypothesis

	<i>p</i> value	Relation to hypothesis
H1 contextual information		
Content of narrative		
Proportion of facts	.03	More factual than speculative narrative with contextual information
H3 asking questions		
Content of questions		
Action-Items	.01	More Action-Items when asking questions
Item-Items	<.001	Fewer Item-Items when asking questions

information and no contextual information condition with regards to the elements the narratives consisted of. A possible explanation for more Action-items in narratives in the questions condition is that while asking questions, a story is already being constructed in one's mind.

In general, across all conditions, the narratives mainly consisted of Action-items. That finding is in line with the description of a good narrative by Pennington and Hastie (1993). The interpretation of facts leads up to a coherent narrative in which the relationship between these facts is considered. A good narrative is structured in a certain way. To reach a certain goal, the main character takes actions that have consequences. Actions are thus core elements of a narrative. Traces themselves do not tell the story when reconstructing a crime, one or more actions are always linked with the traces to give them meaning (Delémont, Lock, & Ribeaux, 2014). Although actions are necessary components of a story, one should be aware that they are always based on inferences when reconstructing a crime in hindsight.

We found that the narratives of participants who received contextual information contained significantly more factual elements rather than interpretations, compared to the narratives of those who did not. Participants who were provided with contextual information had indeed more factual information to start with compared to those who had not, but the effect was not present for participants who were or were not allowed to ask questions. In other words, both participants in the contextual information and the question condition had more information compared to participants in the no contextual information condition and the no questions condition. However, we only found a difference between the contextual information/no contextual information groups and not, as one might also expect, between the question/no question conditions. Furthermore, participants did not include all of the information they were given into their final narrative. Perhaps, receiving prior information is different from receiving answers to questions that are formulated during the investigation with a certain hypothesis or scenario in mind. The former may serve as a framework at the start of the investigation to see and understand the facts of a crime, and thus helps with the reconstruction of events.

The second hypothesis predicted that the narrative would be more extensive for participants in the contextual information and asking questions conditions compared to the no contextual information and no questions conditions. Also, it was predicted that participants' confidence in the accuracy of their narrative would be higher for participants in the contextual information and questions allowed conditions compared to the no contextual information and no questions allowed conditions. Results did not provide sufficient evidence to support this predicted interaction. A minor remark is that participants only gave one confidence rating for the whole narrative, even if they provided multiple possible scenarios in that narrative. It could be that confidence ratings potentially reflect different things for participants who only gave one scenario, compared to those who suggested multiple scenarios.

Contrary to expectations, there was no significant effect of condition on the total number of words in the narrative. Hence, providing contextual information or the opportunity to ask questions did not necessarily lead to lengthier or more accurate narratives. Furthermore, there was no significant effect of condition on confidence scores. It is noteworthy that all participants constructed a fairly lengthy and complete narrative, regardless of the condition they were in, and hence, the amount of information they had at their disposal. This is in accordance with people's tendency to construct complete crime stories even if information is missing (see De Poot et al., 2004). It should, however, be noted that our participants were lay people. It is possible that crime scene investigators would be more resistant to provide a detailed narrative without sufficient information, and would, for example, be more likely to wait until lab results had come back from trace evidence before forming working hypotheses.

The third hypothesis predicted that different questions would be asked, dependent on whether one had prior knowledge or no prior knowledge. We expected that participants would either pick up on the contextual information provided and keep asking questions about those items or ask questions about items that were not present in the prior information and that participants who did not receive prior information would ask questions about all possible items. However, results demonstrated no effect of condition on the types of questions asked. In general, participants asked most questions about *Person*-items (i.e., both the victim and other people involved), and it is an interesting finding that trying to obtain information about the key "actors" is considered the most relevant information in order to reconstruct events.

Receiving contextual information or asking questions did not influence whether participants felt they had enough information to base their narrative on. That finding may be explained by the fact that the participants did not know

there was more or less information available dependent on the condition they were in, and thus did not realise they had more or less information compared to others.

Although not a major factor under study, we found that a substantial number of participants ($n = 12$) wrote down "accident" as a possible scenario. In the case used in the present study that was indeed the correct scenario. We were nevertheless surprised by the finding because of (a) the amount of blood in the scene and (b) because we unintentionally primed the scene as a crime, by referring to it as "the crime scene" and mentioning the presence of a "victim." We also found that the correct scenario was more often given when multiple scenarios were written down. Writing down alternative scenarios of course may increase the likelihood of arriving at the correct interpretation of the scene by chance. However, this perhaps also reflected a more flexible mode of reasoning in those participants (i.e., that they were consciously considering multiple options/scenarios).

A potential limitation of this study is that the sample consisted mainly of undergraduate students and may therefore not be representative of those individuals tasked with interpreting crime scenes or of the public more generally. Furthermore, the participants were presented with photographs of a crime scene, instead of assessing a real (mock) crime scene. However, there is evidence that the influence of information on the interpretation of a crime scene can also be assessed in a virtual environment (e.g., Van den Eeden, De Poot, & Van Koppen, 2016). Although the choice of participants and the use of photographs in this study may lower the external validity of the experiment, it should be emphasised that these were deliberate choices. In this manner, with a homogenous sample and still photographs, we tried to maximise the internal validity and minimise variance in order to understand the cognitive processes involved in this type of reasoning and decision-making.

In this study, we assumed that crime scene investigators' reason in ways similar to members of the general public. This is something we do not know for sure. However, for this study, we generated questions and answers by asking experienced crime scene investigators to ask questions about the crime scene. It is important to emphasize that the crime scene investigators asked the same kinds of questions as the students. It is an interesting finding that crime scene investigators and students mainly ask questions about the persons who were involved in the incident. Thus, we demonstrated that student participants are comparable to crime scene investigators in their "information need" and their "question behaviour." A final limitation of this study could include the small sample size that likely limited statistical power.

We expected that this study would provide useful information on the influence of information on the interpretation of a crime scene and the reconstruction of events leading up to a crime. Although the participants were lay people and not crime scene investigators, results of this study indicate that contextual information seems to help to focus on the facts. This finding is encouraging, because during a criminal investigation, it is important to use the facts as the starting point of the investigation. However, it can be questioned whether that is enough to search for and interpret evidence. Reconstructing events before, during, and after the crime is also interpretation, because at the crime scene, the only facts are the consequences of the crime. Results showed that information about the person(s) involved is considered to be vital. A crime story is built around a person, and without a main character, there is no crime story. For example, it is almost impossible to find the perpetrator in a murder case when the victim is unknown. However, this raises the question whether every crime scene is assessed in the same way, and also if this should be the case. It is likely that different schemas are activated that determine what evidence to look for and how to interpret it when the death of a housewife is investigated compared to the death of, for instance, a prostitute. Although the investigation of the crime scene may vary dependent on the scenarios one has in mind, these schemas can also help with efficiently processing the scene.

Information and interpretation may be necessary to complete the crime story and perceive the facts at the crime scene, even though it entails the risk of cognitive bias. Instead of banning information from the crime scene investigation, the focus of future research should be on managing that information to maximise the utility of the information and minimise the risk of bias.

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ENDNOTE

¹ although “fact” is a contentious term, it is being used in this study to simply describe pieces of evidence presented to participants, rather than to infer a legally established and robust standard of evidence

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REFERENCES

- Alba, J. W., & Hasher, L. (1983). Is memory schematic? *Psychological Bulletin*, 93, 203–231.
- Auckland, M. E., Cave, K. R., & Donnelly, N. (2007). Non-target objects can influence perceptual processes during object recognition. *Psychonomical Bulletin & Review*, 14, 332–337. <https://doi.org/10.3758/BF03194073>.
- Baber, C., & Butler, M. (2012). Expertise in crime scene examination: Comparing search strategies of expert and novice crime scene examiners in simulated crime scenes. *Human Factors: The Journal of Human Factors and Ergonomics Society*, 54, 413–424. <https://doi.org/10.1177/0018720812440577>.
- Baber, C., Smith, P., Cross, J., Hunter, J., & McMaster, R. (2006). Crime scene investigation as distributed cognition. *Pragmatics and Cognition*, 14, 357–385.
- Balcetis, E., & Dunning, D. (2006). See what you want to see: Motivational influences on visual perception. *Journal of Personality and Social Psychology*, 91, 612–625. <https://doi.org/10.1037/0022-3514.91.4.612>.
- Bar, M. (2004). Visual objects in context. *Nature Reviews Neuroscience*, 5, 617–629. <https://doi.org/10.1038/nrn1476>.
- Bartlett, F. C. (1932). *Remembering: A study in experimental and social psychology*. Cambridge, UK: Cambridge University Press.
- Bennett, W. L., & Feldman, M. S. (1981). *Reconstructing reality in the courtroom: Justice and judgment in American culture*. New Brunswick, N.J.: Rutgers University Press.
- Biederman, I., Mezzanotte, R. J., & Rabinowitz, J. C. (1982). Scene perception: Detecting and judging objects undergoing relational violations. *Cognitive Psychology*, 14, 143–177. [https://doi.org/10.1016/0010-0285\(82\)90007-x](https://doi.org/10.1016/0010-0285(82)90007-x).
- De Poot, C. J., Bokhorst, R. J., van Koppen, P. J., & Muller, E. R. (2004). *Rechercheportret: Over dilemma's in de opsporing [portrait of detectives: about dilemmas in the investigative process]*. Alphen aan den Rijn: Kluwer.
- Delémont, O., Lock, E., & Ribeaux, O. (2014). Forensic science and criminal investigation. In G. Bruinsma, & D. Weisburd (Eds.), *Wiley Encyclopedia of criminology and criminal justice* (pp. 1754–1763). New York: Springer.
- Dhami, M. K. (2003). Psychological models of professional decision-making. *Psychological Science*, 14, 175–180. <https://doi.org/10.1111/1467-9280.01438>.
- Dhami, M. K., & Harries, C. (2001). Fast and frugal versus regression models of human judgement. *Thinking and Reasoning*, 7, 5–27. <https://doi.org/10.1080/13546780042000019>.
- Dror, I. E., Charlton, D., & Péron, A. (2006). Contextual information renders experts vulnerable to making erroneous identifications. *Forensic Science International*, 156, 174–178. <https://doi.org/10.1016/j.forsciint.2005.10.017>.
- Edwards, W. (1954). The theory of decision making. *Psychological Bulletin*, 51, 380–417.
- Egeth, H. E., & Yantis, S. (1997). Visual attention: Control, representation, and time course. *Annual Review Psychology*, 48, 269–297. <https://doi.org/10.1146/annurev.psych.48.1.269>.
- Fisher, G. H. (1968). Ambiguity of form: Old and new. *Perception & Psychophysics*, 4, 189–192. <https://doi.org/10.3758/BF03210466>.
- Gick, M. L., & Holyoak, K. J. (1980). Analogical problem solving. *Cognitive Psychology*, 12, 306–355.
- Gigerenzer, G. (2001). The adaptive toolbox. In G. Gigerenzer, & R. Selten (Eds.), *Bounded rationality: The adaptive toolbox*. Cambridge: The MIT Press.
- Gigerenzer, G., Todd, P. M., & ABC Research Group (1999). *Simple heuristics that make us smart*. New York: Oxford University Press.
- Gobet, F. (1998). Expert memory: A comparison of four theories. *Cognition*, 66, 115–152.
- Gregory, R. L. (1968). Perceptual illusions and brain models. *Proceedings of the Royal Society of London. Series B, Biological Sciences*, 171, 270–296.
- Gross, H. (1893). *Handbuch für Untersuchungsrichter als System der Kriministik*. Berlin: J. Schweizer Verlag.
- Haroon, M., & Philips, R. (2010). There is nothing like looking, if you want to find something – Asking questions and searching for answers – The evidence based approach. *Archives of Disease in Childhood - Education and Practice*, 95, 34–39. <https://doi.org/10.1136/adc.2009.161570>.

- Hastie, R. (1981). Schematic principles in human memory. In E. T. Higgins, C. P. Herman & M. P. Zanna (Eds.), *Social cognition: The Ontario symposium* (pp. 39–88). Hillsdale, NJ: Erlbaum.
- Innes, M. (2003). *Investigating murder: Detective work and the police response to criminal homicide*. Oxford, UK: Oxford University Press.
- Johnson-Laird, P. N., & Wason, P. C. (1977). Introduction to interference and comprehension. In P. N. Johnson-Laird, & P. C. Wason (Eds.), *Thinking: Readings in cognitive science* (pp. 341–354). Cambridge: Cambridge University Press.
- Kassin, S. M., Dror, I. E., & Kukucka, J. (2013). The forensic confirmation bias: Problems, perspectives, and proposed solutions. *Journal of Applied Research in Memory and Cognition*, 2, 42–52. <https://doi.org/10.1016/j.jarmac.2013.01.001>.
- Klein, G. (1989). Recognition-primed decisions. In W. B. Rouse (Ed.), *Advances in Man-Machine System Research (Vol 5)* (pp. 47–92). Greenwich CT: JAI Press.
- Klein, G. (1997). The Recognition-Primed Decision (RPD) model: looking back, looking forward. In C. E. Zsombok, & G. A. Klein (Eds.), *Naturalistic Decision Making* (pp. 285–292). New Jersey: Lawrence Erlbaum Associates.
- Nickerson, R. S. (1998). Confirmation bias: A ubiquitous phenomenon in many guises. *Review of General Psychology*, 2, 175–220. <https://doi.org/10.1037/1089-2680.2.2.175>.
- Oxburgh, G., Ost, J., & Cherryman, J. (2012). Police interviews with suspected child sex offenders: Does use of empathy and question type influence the amount of investigation relevant information obtained? *Psychology, Crime & Law*, 18, 259–273. <https://doi.org/10.1080/1068316X.2010.481624>.
- Palmer, S. E. (1975). The effects of contextual scenes on the identification of objects. *Memory & Cognition*, 3, 519–526. <https://doi.org/10.3758/bf03197524>.
- Pennington, N., & Hastie, R. (1986). Evidence evaluation in complex decision making. *Journal of Personality and Social Psychology*, 51, 242–258. <https://doi.org/10.1037//0022-3514.51.2.242>.
- Pennington, N., & Hastie, R. (1992). Explaining the evidence: Tests of the story model for juror decision making. *Journal of Personality and Social Psychology*, 62, 189–206. <https://doi.org/10.1037//0022-3514.62.2.189>.
- Pennington, N., & Hastie, R. (1993). Reasoning in explanation-based decision making. *Cognition*, 49, 123–163. [https://doi.org/10.1016/0010-0277\(93\)90038-w](https://doi.org/10.1016/0010-0277(93)90038-w).
- Rosenthal, R. (1994). Interpersonal expectancy effects: A 30-year perspective. *Current Directions in Psychological Science*, 3, 176–179. <https://doi.org/10.1111/1467-8721.ep10770698>.
- Scocchia, L., Valsecchi, M., & Triesch, J. (2014). Top-down influences on ambiguous perception: The role of stable and transient states of the observer. *Frontiers in Human Neuroscience*, 8, 1–18. <https://doi.org/10.3389/fnhum.2014.00979>.
- Smith, L., & Gilhooly, K. (2006). Regression versus fast and frugal models of decision-making: The case of prescribing for depression. *Applied Cognitive Psychology*, 20, 265–274. <https://doi.org/10.1002/acp.1189>.
- Snook, B., Taylor, P. J., & Bennell, C. (2004). Geographic profiling: The fast, frugal, and accurate way. *Applied Cognitive Psychology*, 18, 105–121. <https://doi.org/10.1002/acp.956>.
- Theeuwes, J. (2010). Top-down and bottom-up control of visual selection. *Acta Psychologica*, 135, 77–99. <https://doi.org/10.1016/j.actpsy.2010.02.006>.
- Tuckey, M., & Brewer, N. (2003). How schemas affect eyewitness memory over repeated retrieval attempts. *Applied Cognitive Psychology*, 17, 785–800. <https://doi.org/10.1002/acp.906>.
- Tversky, A., & Kahneman, D. (1974). Judgement under uncertainty: Heuristics and biases. *Science*, 185, 1124–1131. <https://doi.org/10.1126/science.185.4157.1124>.
- Van den Eeden, C. A. J., De Poot, C. J., & Van Koppen, P. J. (2016). Forensic expectations: Investigating a crime scene with prior information. *Science & Justice*, 56, 475–481.
- Wagenaar, W. A., Van Koppen, P. J., & Crombag, H. F. M. (1993). *Anchored narratives: The psychology of criminal evidence*. London: Harvester Wheatsheaf.
- Wolfe, J. M. (1994). Guided search 2.0: A revised model of visual search. *Psychonomic Bulletin & Review*, 1, 202–238. <https://doi.org/10.3758/bf03200774>.

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APPENDIX A.

CRIME QUESTIONS AND ANSWERS

1. Who are registered at this address?
A married couple and their son
2. What is the age of the residents?
37 (m), 36 (f) and 3 (child)
3. How old is the victim?
36
4. Where there children in the house?
Yes
5. How many children?
1
6. Was this the victim's child?
Yes
7. Are there other people who have a key to the house?
The husband's parents
8. Who were inside the house when the emergency services came in?
Victim and husband
9. Who is the victim
Susan Gilbertson
10. Where is the victim?
In the hospital
11. Where are the other residents?
At the police station
12. Is there a possible perpetrator known?
No
13. Do the residents smoke?
No
14. Were the emergency services called?
Yes
15. What was the emergency call?
A woman had become unwell
16. Who made the emergency call/reported incident?
A male
17. Who was that male?
The husband
18. Was the victim still alive when the emergency services came in?
Yes
19. Was the victim responsive?
No
20. Is the victim alive at this moment?
Unknown
21. Are the others residents able to make a statement at this point?
No

22. Did the neighbours see anything?
No
23. Did the neighbours hear anything?
Yes, a scream and a bang
24. Are there other witnesses?
No, only the neighbours
25. What kind of clothing did the victim wear?
Pyjamas
26. What about the clothing of the victim? Was there anything unusual? Were they damaged?
Cut open by the emergency services
27. What does the upstairs of the house look like?
Two bedrooms and a bathroom
28. Is there blood at the upstairs of the house?
Yes
29. Where is the blood at the upstairs found?
on the floor and wall
30. Is it a lot of blood?
Some smears
31. How many bedrooms are there in the house?
Two
32. Have the beds been slept on?
Yes
33. What does the outside area of the house look like?
Tiled front garden
34. Are there indications of a fight in the outside area of the house?
No
35. Are there damages to the outside area of the house?
No
36. Where was the victim found?
In the kitchen, at the bottom of the stairs
37. How was the victim found?
Lying on her back
38. Has a weapon been found in the house?
No
39. Has a weapon been found outside the house?
No
40. Can by the wounding at the body be seen which weapon is possibly used?
There is damage to the head an skull
41. How much blood is found in the house?
A pool in the kitchen and some smears on the floor, wall and stairwell
42. Was the front door locked or unlocked?
The front door was unlocked
43. Were the doors and windows open or closed?
The doors and windows were closed

44. Are there signs of a forced entry?
No
45. When was the incident reported?
October 25
46. What day of the week?
Saturday
47. What time was the incident reported?
9.18 a.m.
48. Were the lights on or off?
On
49. When was the victim last seen alive?
October 25
50. Who was the last person to see the victim alive?
unknown
51. Were the curtains closed?
Yes
52. Does the victim have a criminal record?
No
53. Does another family member have a criminal record?
No
54. Has anything been stolen?
Unknown
55. Who have been at the crime scene?
Emergency services
56. Have they moved any items?
No
57. Did the people from the emergency services wear gloves?
Yes
58. Who was the first person present at the scene?
Emergency services after the incident was reported
59. Is the furniture moves?
Not by the emergency services
60. Was the victim employed?
Yes
61. Was the husband employed?
Yes
62. What kind of job does the victim have?
Secretary
63. What kind of job does the husband have?
Local government
64. Were they in debt?
No